

SEQUENCE LISTING

<110> Dhugga, Kanwarpal S.
Niu, Xiaomu
Helentjaris, Timothy

<120> Manipulation of Sucrose Synthase Genes
to Improve Stalk and Grain Quality

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<151> 2001-02-22

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10030114-022102

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Glu Leu Ser Val Glu Gln Leu Thr Val Ser Glu Tyr Leu Arg Phe Lys
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Ser Ile Gly Asn Gly Val Gln Phe Leu Asn Arg His Leu Ser Ser Ile
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Ser Lys Leu Pro Ala Asp Thr Pro Tyr Ser Gln Phe Ala Tyr Lys Phe
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Gln Glu Trp Gly Leu Glu Lys Gly Trp Gly Asp Thr Ala Gly His Val
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Leu Glu Met Ile His Leu Leu Leu Asp Ile Ile Gln Ala Pro Asp Pro
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Ser Thr Leu Glu Lys Phe Leu Gly Arg Ile Pro Met Ile Phe Asn Val
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Val Val Val Ser Pro His Gly Tyr Phe Gly Gln Ala Asn Val Leu Gly
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1008014-02402

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Val Ser Gly Leu His Ile Asp Pro Tyr His Ser Asp Lys Ala Ala Asp	
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10080114-022102

Pro	Asp	Ala	Ala	Gly	Thr	Thr	Cys	Gly	Gln	Arg	Leu	Glu	Lys	Val	Ile	
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Gly	Thr	Glu	His	Thr	Asp	Ile	Ile	Arg	Val	Pro	Phe	Arg	Asn	Glu	Asn	
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Gly	Ile	Leu	Arg	Lys	Trp	Ile	Ser	Arg	Phe	Asp	Val	Trp	Pro	Tyr	Leu	
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Glu	Thr	Tyr	Thr	Glu	Asp	Val	Ser	Ser	Glu	Ile	Met	Lys	Glu	Met	Gln	
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Ala	Lys	Pro	Asp	Leu	Ile	Ile	Gly	Asn	Tyr	Ser	Asp	Gly	Asn	Leu	Val	
				405				410					415			
Ala	Thr	Leu	Leu	Ala	His	Lys	Leu	Gly	Val	Thr	Gln	Cys	Thr	Ile	Ala	
				420				425					430			
His	Ala	Leu	Glu	Lys	Thr	Lys	Tyr	Pro	Asn	Ser	Asp	Ile	Tyr	Leu	Asp	
				435			440					445				
Lys	Phe	Asp	Ser	Gln	Tyr	His	Phe	Ser	Cys	Gln	Phe	Thr	Ala	Asp	Leu	
						455					460					
Ile	Ala	Met	Asn	His	Thr	Asp	Phe	Ile	Ile	Thr	Ser	Thr	Phe	Gln	Glu	
					470					475				480		
Ile	Ala	Gly	Ser	Lys	Asp	Thr	Val	Gly	Gln	Tyr	Glu	Ser	His	Ile	Ala	
				485				490						495		
Phe	Thr	Leu	Pro	Gly	Leu	Tyr	Arg	Val	Val	His	Gly	Ile	Asp	Val	Phe	
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Asp	Pro	Lys	Phe	Asn	Ile	Val	Ser	Pro	Gly	Ala	Asp	Met	Ser	Val	Tyr	
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Tyr	Pro	Tyr	Thr	Glu	Thr	Asp	Lys	Arg	Leu	Thr	Ala	Phe	His	Pro	Glu	
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Val	Leu	Lys	Asp	Lys	Lys	Lys	Pro	Ile	Ile	Phe	Ser	Met	Ala	Arg	Leu	
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Asp	Arg	Val	Lys	Asn	Met	Thr	Gly	Leu	Val	Glu	Met	Tyr	Gly	Lys	Asn	
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Ala	Arg	Leu	Arg	Glu	Leu	Ala	Asn	Leu	Val	Ile	Val	Ala	Gly	Asp	His	
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Gly	Lys	Glu	Ser	Lys	Asp	Arg	Glu	Glu	Gln	Ala	Glu	Phe	Lys	Lys	Met	
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Tyr	Ser	Leu	Ile	Asp	Glu	Tyr	Lys	Leu	Lys	Gly	His	Ile	Arg	Trp	Ile	
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Ser	Ala	Gln	Met	Asn	Arg	Val	Arg	Asn	Gly	Glu	Leu	Tyr	Arg	Tyr	Ile	
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Cys	Asp	Thr	Lys	Gly	Ala	Phe	Val	Gln	Pro	Ala	Phe	Tyr	Glu	Ala	Phe	
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Gly	Leu	Thr	Val	Ile	Glu	Ser	Met	Thr	Cys	Gly	Leu	Pro	Thr	Ile	Ala	
							680					685				
Thr	Cys	His	Gly	Gly	Pro	Ala	Glu	Ile	Ile	Val	Asp	Gly	Val	Ser	Gly	
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Leu	His	Ile	Asp	Pro	Tyr	His	Ser	Asp	Lys	Ala	Ala	Asp	Ile	Leu	Val	
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Asn	Phe	Phe	Asp	Lys	Cys	Lys	Ala	Asp	Pro	Ser	Tyr	Trp	Asp	Glu	Ile	
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Ser	Gln	Gly	Gly	Leu	Gln	Arg	Ile	Tyr	Glu	Lys	Tyr	Thr	Trp	Lys	Leu	
				740				745					750			
Tyr	Ser	Glu	Arg	Leu	Met	Thr	Leu	Thr	Gly	Val	Tyr	Gly	Phe	Trp	Lys	
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Tyr	Val	Ser	Asn	Leu	Glu	Arg	Arg	Glu	Thr	Arg	Arg	Tyr	Ile	Glu	Met	
					770		775				780					
Phe	Tyr	Ala	Leu	Lys	Tyr	Arg	Ser	Leu	Ala	Ser	Gln	Val	Pro	Leu	Ser	
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Phe Asp

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<213> Zea mays

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                1                    5

ctg agc cgc ctc cac agc gtc agg gag cgc att ggc gac tca ctc tct      102
Leu Ser Arg Leu His Ser Val Arg Glu Arg Ile Gly Asp Ser Leu Ser
10                15                20                25

gcc cac ccc aat gag ctt gtc gcc gtc ttc acc agg ctg aaa aac ctt      150
Ala His Pro Asn Glu Leu Val Ala Val Phe Thr Arg Leu Lys Asn Leu
30                35                40

gga aag ggt atg ctg cag ccc cac cag atc att gcc gag tac aac aat      198
Gly Lys Gly Met Leu Gln Pro His Gln Ile Ile Ala Glu Tyr Asn Asn
45                50                55

gcg atc cct gag gct gag cgc gag aag ctc aag gat ggt gct ttt gag      246
Ala Ile Pro Glu Ala Glu Arg Glu Lys Leu Lys Asp Gly Ala Phe Glu
60                65                70

gat gtc ctg agg gca gct cag gag gcg att gtc atc ccc cca tgg gtt      294
Asp Val Leu Arg Ala Ala Gln Glu Ala Ile Val Ile Pro Pro Trp Val
75                80                85

gca ctt gcc atc cgc cct agg cct ggt gtc tgg gag tat gtg agg gtc      342
Ala Leu Ala Ile Arg Pro Arg Pro Gly Val Trp Glu Tyr Val Arg Val
90                95                100                105

aac gtc agt gag ctc gct gtt gag gag ctg aga gtt cct gag tac ctg      390
Asn Val Ser Glu Leu Ala Val Glu Glu Leu Arg Val Pro Glu Tyr Leu
110                115                120

cag ttc aag gaa cag ctt gtg gaa gaa ggc ccc aac aac aac ttt gtt      438
Gln Phe Lys Glu Gln Leu Val Glu Glu Gly Pro Asn Asn Asn Phe Val
125                130                135

ctt gag ctg gac ttt gag cca ttc aat gcc tcc ttc ccc cgt cct tct      486
Leu Glu Leu Asp Phe Glu Pro Phe Asn Ala Ser Phe Pro Arg Pro Ser
140                145                150

ctg tca aag tcc att ggc aat ggc gtg cag ttc ctc aac agg cac ctg      534
Leu Ser Lys Ser Ile Gly Asn Gly Val Gln Phe Leu Asn Arg His Leu
155                160                165

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ttc ctt cgc gcc cac aac tac aag ggg atg acc atg atg ttg aac gac Phe Leu Arg Ala His Asn Tyr Lys Gly Met Thr Met Met Leu Asn Asp 190 195 200	630
aga atc cgc agt ctc agt gct ctg caa ggt gcg ctg agg aag gct gag Arg Ile Arg Ser Leu Ser Ala Leu Gln Gly Ala Leu Arg Lys Ala Glu 205 210 215	678
gag cac ctg tcc acc cta caa gct gat acc cca tac tct gaa ttt cac Glu His Ser Ser Thr Leu Gln Ala Asp Thr Pro Tyr Ser Glu Phe His 220 225 230	726
cac agg ttc cag gaa ctt ggt ctg gag aag ggt tgg ggt gat tgc gct His Arg Phe Gln Glu Leu Gly Leu Glu Lys Gly Trp Gly Asp Cys Ala 235 240 245	774
aag cgt gca cag gag act atc cac ctc ctc ttg gac ctc ctg gag gcc Lys Arg Ala Gln Glu Thr Ile His Leu Leu Leu Asp Leu Leu Glu Ala 250 255 260 265	822
cca gat ccg tcc acc ctg gag aag ttc ctt gga acg atc ccc atg gtg Pro Asp Pro Ser Thr Leu Glu Lys Phe Leu Gly Thr Ile Pro Met Val 270 275 280	870
ttc aat gtc gtt atc ctc tcc cct cat ggt tac ttc gct caa gct aat Phe Asn Val Val Ile Leu Ser Pro His Gly Tyr Phe Ala Gln Ala Asn 285 290 295	918
gtc ttg ggt tac cct gac acc gga gcc cag gtt gtc tac atc ttg gat Val Leu Gly Tyr Pro Asp Thr Gly Gly Gln Val Val Tyr Ile Leu Asp 300 305 310	966
caa gtg cgc gct atg gag aac gaa atg ctg ctg agg atc aag cag tgt Gln Val Arg Ala Met Glu Asn Glu Met Leu Leu Arg Ile Lys Gln Cys 315 320 325	1014
ggt ctt gac atc acg ccg aag atc ctt att gtc acc agg ttg ctc cct Gly Leu Asp Ile Thr Pro Lys Ile Leu Ile Val Thr Arg Leu Leu Pro 330 335 340 345	1062
gat gca act ggc acc acc tgt ggc cag cgc ctt gag aag gtc ctt ggc Asp Ala Thr Gly Thr Thr Cys Gly Gln Arg Leu Glu Lys Val Leu Gly 350 355 360	1110
acc gag cac tgc cat atc ctt cgc gtg cca ttc aga aca gaa aac gga Thr Glu His Cys His Ile Leu Arg Val Pro Phe Arg Thr Glu Asn Gly 365 370 375	1158
atc gtt cgc aag tgg atc tcg cga ttt gaa gtc tgg ccg tac ctg gag Ile Val Arg Lys Trp Ile Ser Arg Phe Glu Val Trp Pro Tyr Leu Glu 380 385 390	1206
act tac act gat gac gtg gcg cat gag att gct gga gag ctt cag gcc Thr Tyr Thr Asp Asp Val Ala His Glu Ile Ala Gly Glu Leu Gln Ala	1254

395	400	405	
aat cct gac ctg atc atc gga aac tac agt gac gga aac ctt gtt gcg Asn Pro Asp Leu Ile Ile Gly Asn Tyr Ser Asp Gly Asn Leu Val Ala 410 415 420 425			1302
tgt ttg ctc gcc cac aag atg ggt gtt act cac tgt acc att gcc cat Cys Leu Leu Ala His Lys Met Gly Val His Cys Thr Ile Ala His 430 435 440			1350
gcg ctt gag aaa act aag tac cct aac tcc gac ctc tac tgg aag aag Ala Leu Glu Lys Thr Lys Tyr Pro Asn Ser Asp Leu Tyr Trp Lys Lys 445 450 455			1398
ttt gag gat cac tac cac ttc tcg tgc cag ttc acc act gac ttg att Phe Glu Asp His Tyr His Phe Ser Cys Gln Phe Thr Thr Asp Leu Ile 460 465 470			1446
gca atg aac cat gcc gac ttc atc atc acc agt acc ttc caa gag atc Ala Met Asn His Ala Asp Phe Ile Ile Thr Ser Thr Phe Gln Glu Ile 475 480 485			1494
gcc gga aac aag gac acc gtc ggc cag tac gag tca cac atg gcg ttc Ala Gly Asn Lys Asp Thr Val Gly Gln Tyr Glu Ser His Met Ala Phe 490 495 500 505			1542
aca atg cct ggc ctg tac cgc gtt gtc cac ggc att gat gtg ttc gac Thr Met Pro Gly Leu Tyr Arg Val Val His His Gly Ile Asp Val Phe Asp 510 515 520			1590
ccc aag ttc aac atc gtg tct cct ggc gcg gac ctg tcc atc tac ttc Pro Lys Phe Asn Ile Val Ser Pro Gly Ala Asp Leu Ser Ile Tyr Phe 525 530 535			1638
ccg tac acc gag tcg cac aag agg ctg acc tcc ctt cac ccg gag att Pro Tyr Thr Glu Ser His Lys Arg Leu Thr Ser Leu His Pro Glu Ile 540 545 550			1686
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cgt gtg aag aac ttg act ggg ctg gtg gag ctg tac ggc cgg aac aag Arg Val Lys Asn Leu Thr Gly Leu Val Glu Leu Tyr Gly Arg Asn Lys 590 595 600			1830
cgg ctg cag gag ctg gtg aac ctc gtg gtc tgc ggc gac cat ggc Arg Leu Gln Glu Leu Val Asn Leu Val Val Cys Gly Asp His Gly 605 610 615			1878
aac cct tcc aag gac aag gag gag cag gcc gag ttc aag aag atg ttt Asn Pro Ser Lys Asp Lys Glu Glu Gln Ala Glu Phe Lys Lys Met Phe 620 625 630			1926

gac ctc atc gag cag tac aac ctg aac ggg cac atc cgc tgg atc tcc Asp Leu Ile Glu Gln Tyr Asn Leu Asn Gly His Ile Arg Trp Ile Ser 635 640 645	1974
gcc cag atg aac cgc gtc cgc aac ggc gag ctg tac cgc tac atc tgc Ala Gln Met Asn Arg Val Arg Asn Gly Glu Leu Tyr Arg Tyr Ile Cys 650 655 660 665	2022
gac acc aag ggc gcc ttc gtg cag cct gct ttc tac gag gct ttc ggg Asp Thr Lys Gly Ala Phe Val Gln Pro Cys Gly Phe Tyr Glu Ala Phe Gly 670 675 680	2070
ctg acg gtg gtt gag gcc atg acc tgc ggc ctg ccc acg ttc gcc acc Leu Thr Val Val Glu Ala Met Thr Cys Gly Leu Pro Thr Phe Ala Thr 685 690 695	2118
gcc tac ggc ggt cgc gcc gag atc atc gtg cac ggc gtg tct ggc tac Ala Tyr Gly Gly Pro Ala Glu Ile Ile Val His Gly Val Ser Gly Tyr 700 705 710	2166
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ttc ttc gac aag tgc cag gcg gag ccg agc cac tgg agc aag atc tcc Phe Phe Asp Lys Cys Gln Ala Glu Pro Ser His Trp Ser Lys Ile Ser 730 735 740 745	2262
cag ggc ggg ctc cag cgt atc gag gag aag tac acc tgg aag ctg tac Gln Gly Gly Leu Gln Arg Ile Glu Glu Lys Tyr Thr Trp Lys Leu Tyr 750 755 760	2310
tcg gag agg ctg atg acc ctc acc ggc gtg tac ggg ttc tgg aag tac Ser Glu Arg Leu Met Thr Leu Thr Gly Val Tyr Gly Phe Trp Lys Tyr 765 770 775	2358
gtg tcc aac ctg gag agg cgc gag acc cgg cgg tac ctg gag atg ctg Val Ser Asn Leu Glu Arg Arg Glu Thr Arg Arg Tyr Leu Glu Met Leu 780 785 790	2406
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gag gga gag ccc tcc agc aag tga tgcgtgacgg cggccacaga cctgatcgat Glu Gly Glu Pro Ser Ser Lys * 810 815	2508
cgatgagcga gagggagcac tcggagtgtc gtgtcttttc ccttgccatt tctttctttc ttcttttttc ttcccggagg cgaaaaaaaa agagtctgct tttgctaggc ggcggggcgtt cgttgctgct ctttgcttca agagttaaaa ttacctaacc ttgtcaaggt cttgttccat cattgatccg ggtgtcgctt gtagtagtgt gatggactgt tagtagtttg cgttgcgctg gttgagaggg aacgttgggt gtgggtgggt gtgtgcagtc aggcgtgggt ctccccttgt ttcctggatg ggaagtgtct ccttgaataa taatcgtagt ggcctggag cctcttttct gaaataagag cagcattccta gtgcttaacct ttgcagctgt	2568 2628 2688 2748 2808 2868 2908

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<212> PRT
<213> Zea mays

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Ala Val Phe Thr Arg Leu Lys Asn Leu Gly Lys Gly Met Leu Gln Pro
35     40     45
His Gln Ile Ile Ala Glu Tyr Asn Asn Ala Ile Pro Glu Ala Glu Arg
50     55     60
Glu Lys Leu Lys Asp Gly Ala Phe Glu Asp Val Leu Arg Ala Ala Gln
65     70     75     80
Glu Ala Ile Val Ile Pro Pro Trp Val Ala Leu Ala Ile Arg Pro Arg
85     90     95
Pro Gly Val Trp Glu Tyr Val Arg Val Asn Val Ser Glu Leu Ala Val
100    105    110
Glu Glu Leu Arg Val Pro Glu Tyr Leu Gln Phe Lys Glu Gln Leu Val
115    120    125
Glu Glu Gly Pro Asn Asn Asn Phe Val Leu Glu Leu Asp Phe Glu Pro
130    135    140
Phe Asn Ala Ser Phe Pro Arg Pro Ser Leu Ser Lys Ser Ile Gly Asn
145    150    155    160
Gly Val Gln Phe Leu Asn Arg His Leu Ser Ser Lys Leu Phe His Asp
165    170    175
Lys Glu Ser Met Tyr Pro Leu Leu Asn Phe Leu Arg Ala His Asn Tyr
180    185    190
Lys Gly Met Thr Met Met Leu Asn Asp Arg Ile Arg Ser Leu Ser Ala
195    200    205
Leu Gln Gly Ala Leu Arg Lys Ala Glu Glu His Leu Ser Thr Leu Gln
210    215    220
Ala Asp Thr Pro Tyr Ser Glu Phe His His Arg Phe Gln Glu Leu Gly
225    230    235    240
Leu Glu Lys Gly Trp Gly Asp Cys Ala Lys Arg Ala Gln Glu Thr Ile
245    250    255
His Leu Leu Leu Asp Leu Leu Glu Ala Pro Asp Pro Ser Thr Leu Glu
260    265    270
Lys Phe Leu Gly Thr Ile Pro Met Val Phe Asn Val Val Ile Leu Ser
275    280    285
Pro His Gly Tyr Phe Ala Gln Ala Asn Val Leu Gly Tyr Pro Asp Thr
290    295    300
Gly Gly Gln Val Val Tyr Ile Leu Asp Gln Val Arg Ala Met Glu Asn
305    310    315    320
Glu Met Leu Leu Arg Ile Lys Gln Cys Gly Leu Asp Ile Thr Pro Lys
325    330    335
Ile Leu Ile Val Thr Arg Leu Leu Pro Asp Ala Thr Gly Thr Thr Cys
340    345    350
Gly Gln Arg Leu Glu Lys Val Leu Gly Thr Glu His Cys His Ile Leu
355    360    365
Arg Val Pro Phe Arg Thr Glu Asn Gly Ile Val Arg Lys Trp Ile Ser
370    375    380
Arg Phe Glu Val Trp Pro Tyr Leu Glu Thr Tyr Thr Asp Asp Val Ala
385    390    395    400
His Glu Ile Ala Gly Glu Leu Gln Ala Asn Pro Asp Leu Ile Ile Gly
405    410    415
Asn Tyr Ser Asp Gly Asn Leu Val Ala Cys Leu Leu Ala His Lys Met
420    425    430

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Gly Val Thr His Cys Thr Ile Ala His Ala Leu Glu Lys Thr Lys Tyr
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 465 470 475 480
 Ile Ile Thr Ser Thr Phe Gln Glu Ile Ala Gly Asn Lys Asp Thr Val
 485 490 495
 Gly Gln Tyr Glu Ser His Met Ala Phe Thr Met Pro Gly Leu Tyr Arg
 500 505 510
 Val Val His Gly Ile Asp Val Phe Asp Pro Lys Phe Asn Ile Val Ser
 515 520 525
 Pro Gly Ala Asp Leu Ser Ile Tyr Phe Pro Tyr Thr Glu Ser His Lys
 530 535 540
 Arg Leu Thr Ser Leu His Pro Glu Ile Glu Glu Leu Leu Tyr Ser Gln
 545 550 555 560
 Thr Glu Asn Thr Glu His Lys Phe Val Leu Asn Asp Arg Asn Lys Pro
 565 570 575
 Ile Ile Phe Ser Met Ala Arg Leu Asp Arg Val Lys Asn Leu Thr Gly
 580 585 590
 Leu Val Glu Leu Tyr Gly Arg Asn Lys Arg Leu Gln Glu Leu Val Asn
 595 600 605
 Leu Val Val Val Cys Gly Asp His Gly Asn Pro Ser Lys Asp Lys Glu
 610 615 620
 Glu Gln Ala Glu Phe Lys Lys Met Phe Asp Leu Ile Glu Gln Tyr Asn
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 Leu Asn Gly His Ile Arg Trp Ile Ser Ala Gln Met Asn Arg Val Arg
 645 650 655
 Asn Gly Glu Leu Tyr Arg Tyr Ile Cys Asp Thr Lys Gly Ala Phe Val
 660 665 670
 Gln Pro Ala Phe Tyr Glu Ala Phe Gly Leu Thr Val Val Glu Ala Met
 675 680 685
 Thr Cys Gly Leu Pro Thr Phe Ala Thr Ala Tyr Gly Gly Pro Ala Glu
 690 695 700
 Ile Ile Val His Gly Val Ser Gly Tyr His Ile Asp Pro Tyr Gln Gly
 705 710 715 720
 Asp Lys Ala Ser Ala Leu Leu Val Asp Phe Phe Asp Lys Cys Gln Ala
 725 730 735
 Glu Pro Ser His Trp Ser Lys Ile Ser Gln Gly Gly Leu Gln Arg Ile
 740 745 750
 Glu Glu Lys Tyr Thr Trp Lys Leu Tyr Ser Glu Arg Leu Met Thr Leu
 755 760 765
 Thr Gly Val Tyr Gly Phe Trp Lys Tyr Val Ser Asn Leu Glu Arg Arg
 770 775 780
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 Glu Asp Thr Leu His Ala His Arg Asn Glu Leu Val Ala Leu Leu Ser
 20 25 30

aag tac gtg aac aag ggg aag ggc atc ctg cag ccg cac cac atc ctc 144
 Lys Tyr Val Asn Lys Gly Lys Gly Ile Leu Gln Pro His His Ile Leu
 35 40 45

gac gcg ctc gac gag gtc cag ggc tcc ggg gtc cgc gcg ctc gcc gag 192
 Asp Ala Leu Asp Glu Val Gln Gly Ser Gly Val Arg Ala Leu Ala Glu
 50 55 60

gga ccc ttc ctc gac gtc ctc cgc tcc gcg cag gag gcg atc gtg ctg 240
 Gly Pro Phe Leu Asp Val Leu Arg Ser Ala Gln Glu Ala Ile Val Leu
 65 70 75 80

ccg ccg ttc gtg gcc atc gcg gtg cgc ccg cgc ccg gga gtt tgg gag 288
 Pro Pro Phe Val Ala Ile Ala Val Arg Pro Arg Pro Gly Val Trp Glu

85										90										95										
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Tyr	Val	Arg	Val	Asn	Val	His	Glu	Leu	Ser	Val	Glu	Gln	Leu	Thr	Val															
100										105										110										
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Ser	Glu	Tyr	Leu	Arg	Phe	Lys	Glu	Glu	Leu	Val	Asp	Gly	Gln	His	Asn															
115										120										125										
gat	ccc	tac	gtt	ctc	gag	ctt	gac	ttc	gag	ccg	ttc	aat	gtc	tca	gtc	432														
Asp	Pro	Tyr	Val	Leu	Glu	Leu	Asp	Phe	Glu	Pro	Phe	Asn	Val	Ser	Val															
130										135										140										
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Pro	Arg	Pro	Asn	Arg	Ser	Ser	Ser	Ile	Gly	Asn	Gly	Val	Gln	Phe	Leu															
145										150										155										
aac	cga	cac	ttg	tcc	tca	atc	atg	ttc	cgc	aac	agg	gat	tgc	ttg	gag	528														
Asn	Arg	His	Leu	Ser	Ser	Ile	Met	Phe	Arg	Asn	Arg	Asp	Cys	Leu	Glu															
165										170										175										
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Pro	Leu	Leu	Asp	Phe	Leu	Arg	Gly	His	Arg	His	Lys	Gly	His	Val	Met															
180										185										190										
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195										200										205										
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Thr	Lys	Ala	Glu	Glu	His	Leu	Ser	Lys	Leu	Pro	Ala	Asp	Thr	Pro	Tyr															
210										215										220										
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225										230										235										
ggg	gat	aca	gca	gga	cat	gtt	ttg	gaa	atg	atc	cat	ctc	ctt	cta	gac	768														
Gly	Asp	Thr	Ala	Gly	His	Val	Leu	Glu	Met	Ile	His	Leu	Leu	Leu	Asp															
245										250										255										
atc	att	cag	cgc	cca	gac	cca	tct	acc	cta	gag	aaa	ttc	ttg	ggg	agg	816														
Ile	Ile	Gln	Ala	Pro	Asp	Pro	Ser	Thr	Leu	Glu	Lys	Phe	Leu	Gly	Arg															
260										265										270										
atc	ccc	atg	att	ttt	aac	gtt	gtt	gtg	gta	tcc	cct	cat	gga	tac	ttt	864														
Ile	Pro	Met	Ile	Phe	Asn	Val	Val	Val	Val	Ser	Pro	His	Gly	Tyr	Phe															
275										280										285										
ggg	caa	gct	aat	gta	tta	ggc	ttg	cca	gac	aca	gga	gga	cag	atc	gtc	912														
Gly	Gln	Ala	Asn	Val	Leu	Gly	Leu	Pro	Asp	Thr	Gly	Gly	Gln	Ile	Val															
290										295										300										
tat	ata	ctg	gac	caa	gtc	cgt	gca	cta	gaa	aat	gag	atg	gtt	ctc	cgt	960														
Tyr	Ile	Leu	Asp	Gln	Val	Arg	Ala	Leu	Glu	Asn	Glu	Met	Val	Leu	Arg															
305										315										320										

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tta aag aaa caa ggg ctt gat gtt tcc cca aag att ctc att gtt act	1008
Leu Lys Lys Gln Gly Leu Asp Val Ser Pro Lys Ile Leu Ile Val Thr	
325 330 335	
cgg ctg ata cca gat gca aaa gga aca tca tgc aat cag cgg ctt gag	1056
Arg Leu Ile Pro Asp Ala Lys Gly Thr Ser Cys Asn Gln Arg Leu Glu	
340 345 350	
aga att agt gga aca cag cat act tac ata tta cga gtt ccc ttc aga	1104
Arg Ile Ser Gly Thr Gln His Thr Tyr Ile Leu Arg Val Pro Phe Arg	
355 360 365	
aat gaa aat ggg ata ctt aag aaa tgg ata tca aga ttt gat gtg tgg	1152
Asn Glu Asn Gly Ile Leu Lys Lys Trp Ile Ser Arg Phe Asp Val Trp	
370 375 380	
cca tat ctg gaa aca ttt gct gag gat gct gct ggt gaa att gct gct	1200
Pro Tyr Leu Glu Thr Phe Ala Glu Asp Ala Ala Gly Glu Ile Ala Ala	
385 390 395 400	
gaa tta caa ggt act cca gac ttc ata att gga aac tac agt gat gga	1248
Glu Leu Gln Gly Thr Pro Asp Phe Ile Ile Gly Asn Tyr Ser Asp Gly	
405 410 415	
aat ctt gtg gcg tca ttg cta tct tac aag atg gga att acc cag tgc	1296
Asn Leu Val Ala Ser Leu Leu Ser Tyr Lys Met Gly Ile Thr Gln Cys	
420 425 430	
aac att gct cat gct ctg gaa aag act aag tat cca gat tca gac ata	1344
Asn Ile Ala His Ala Leu Glu Lys Thr Lys Tyr Pro Asp Ser Asp Ile	
435 440 445	
ttt tgg aag aat ttc gat gag aag tac cat ttc tcc tgc cag ttc act	1392
Phe Trp Lys Asn Phe Asp Glu Lys Tyr His Phe Ser Cys Gln Phe Thr	
450 455 460	
gct gat ata att gct atg aac aat gct gat ttt atc atc acc agc aca	1440
Ala Asp Ile Ile Ala Met Asn Asn Ala Asp Phe Ile Ile Thr Ser Thr	
465 470 475 480	
tac caa gaa att gct gga agc aaa aat act gtt gga cag tat gag agt	1488
Tyr Gln Glu Ile Ala Gly Ser Lys Asn Thr Val Gly Gln Tyr Glu Ser	
485 490 495	
cat act gcc ttt act ctg cct ggt ctg tac cga gtt gtc cat ggg atc	1536
His Thr Ala Phe Thr Leu Pro Gly Leu Tyr Arg Val Val His Gly Ile	
500 505 510	
gat gtc ttc gat cca aag ttc aat ata gtc tct cct gga gct gac atg	1584
Asp Val Phe Asp Pro Lys Phe Asn Ile Val Ser Pro Gly Ala Asp Met	
515 520 525	
tcc ata tac ttt cca cat acc gag aag gcc aag cga ctc acc tct ctt	1632
Ser Ile Tyr Phe Pro His Thr Glu Lys Ala Lys Arg Leu Thr Ser Leu	
530 535 540	
cat ggt tca atc gaa aat ttg att tat gac ccg gag caa aac gat gaa	1680
His Gly Ser Ile Glu Asn Leu Ile Tyr Asp Pro Glu Gln Asn Asp Glu	

545	550	555	560
cac att ggg cat ctg gat gac cgg tca aag ccc atc ctc ttc tcc atg His Ile Gly His Leu Asp Asp Arg Ser Lys Pro Ile Leu Phe Ser Met	565	570	575
1728			
gca aga ctc gac agg gtg aag aac ata aca ggg ctg gtc gaa gct ttt Ala Arg Leu Asp Arg Val Lys Asn Ile Thr Gly Leu Val Glu Ala Phe	580	585	590
1776			
gct aag tgc gct aag ctg agg gag ctg gta aac ctt gtc gtc gtt gcc Ala Lys Cys Ala Lys Leu Arg Glu Leu Val Asn Leu Val Val Val Ala	595	600	605
1824			
ggg tac aat gat gtc aac aag tcc aag gac agg gaa gag atc gcg gag Gly Tyr Asn Asp Val Asn Lys Ser Lys Asp Arg Glu Ile Ala Glu	610	615	620
1872			
ata gag aag atg cat gaa ctc atc aag acc cac aac ttg ttc ggg cag Ile Glu Lys Met His Glu Leu Ile Lys Thr His Asn Leu Phe Gly Gln	625	630	635
1920			
ttc cgc tgg atc tct gcc cag aca aac agg gcc cgt aac ggc gag ctc Phe Arg Trp Ile Ser Ala Gln Thr Asn Arg Ala Arg Asn Gly Glu Leu	645	650	655
1968			
tat cgc tac atc gct gat acc cat ggt gct ttc gta cag ccg gcc ttg Tyr Arg Tyr Ile Ala Asp Thr His Gly Ala Phe Val Gln Pro Ala Leu	660	665	670
2016			
tat gaa cgc ttc ggt ctc acc gtc gtt gag gcc atg acc tgt ggg ctt Tyr Glu Ala Phe Gly Leu Thr Val Val Glu Ala Met Thr Cys Gly Leu	675	680	685
2064			
cct act ttc cgc acg ctc cat gga ggt cca gct gag atc ata gag cat Pro Thr Phe Ala Thr Leu His Gly Gly Pro Ala Glu Ile Ile Glu His	690	695	700
2112			
ggc gtc tcg ggc ttc cac att gac ccg tac cac ccc gaa cag gct gtt Gly Val Ser Gly Phe His Ile Asp Pro Tyr His Pro Glu Gln Ala Val	705	710	715
2160			
aat ctg atg gcc gac ttc ttc gac cgg tgc aag caa gac cca gat cac Asn Leu Met Ala Asp Phe Phe Asp Arg Cys Lys Gln Asp Pro Asp His	725	730	735
2208			
tgg gtg aat ata tct gga gca ggg ctg cag cgc ata tac gag aag tac Trp Val Asn Ile Ser Gly Ala Gly Leu Gln Arg Ile Tyr Glu Lys Tyr	740	745	750
2256			
aca tgg aag ata tac tca gag agg ttg atg aca ctg gcc ggg gtc tac Thr Trp Lys Ile Tyr Ser Glu Arg Leu Met Thr Leu Ala Gly Val Tyr	755	760	765
2304			
ggt ttc tgg aag tac gtg tcg aag ctc gag agg ctg gag acg agg cgc Gly Phe Trp Lys Tyr Val Ser Lys Leu Glu Arg Leu Glu Thr Arg Arg	770	775	780
2352			

tac ctt gag atg ttc tac ata ctg aag ttc cgc gag ctg gcg aag acc 2400
Tyr Leu Glu Met Phe Tyr Ile Leu Lys Phe Arg Glu Leu Ala Lys Thr
785 790 795 800

gtg cgc ctt gca att gac caa cgc cag tag cttgcgcaac tgcgactgcg 2450
Val Pro Leu Ala Ile Asp Gln Pro Gln *
805

tagcacttgg tacaagactg aaacctgaag gaccttcagt aatttaggcg cggcgagacgg 2510
tagccaataa aatgtgccgg agctgaactg gttttttatt atgtacataa tggcagatata 2570
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Glu Asp Thr Leu His Ala His Arg Asn Glu Leu Val Ala Leu Leu Ser
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Lys Tyr Val Asn Lys Gly Lys Gly Ile Leu Gln Pro His His Ile Leu
35 40 45
Asp Ala Leu Asp Glu Val Gln Gly Ser Gly Val Arg Ala Leu Ala Glu
50 55 60
Gly Pro Phe Leu Asp Val Leu Arg Ser Ala Gln Glu Ala Ile Val Leu
65 70 75 80
Pro Pro Phe Val Ala Ile Ala Val Arg Pro Arg Pro Gly Val Trp Glu
85 90 95
Tyr Val Arg Val Asn Val His Glu Leu Ser Val Glu Gln Leu Thr Val
100 105 110
Ser Glu Tyr Leu Arg Phe Lys Glu Glu Leu Val Asp Gly Gln His Asn
115 120 125
Asp Pro Tyr Val Leu Glu Leu Asp Phe Glu Pro Phe Asn Val Ser Val
130 135 140
Pro Arg Pro Asn Arg Ser Ser Ser Ile Gly Asn Gly Val Gln Phe Leu
145 150 155 160
Asn Arg His Leu Ser Ser Ile Met Phe Arg Asn Arg Asp Cys Leu Glu
165 170 175
Pro Leu Leu Asp Phe Leu Arg Gly His Arg His Lys Gly His Val Met
180 185 190
Met Leu Asn Asp Arg Ile Gln Ser Leu Gly Arg Leu Gln Ser Val Leu
195 200 205
Thr Lys Ala Glu Glu His Leu Ser Lys Leu Pro Ala Asp Thr Pro Tyr
210 215 220
Ser Gln Phe Ala Tyr Lys Phe Gln Glu Trp Gly Leu Glu Lys Gly Trp
225 230 235 240
Gly Asp Thr Ala Gly His Val Leu Glu Met Ile His Leu Leu Leu Asp
245 250 255
Ile Ile Gln Ala Pro Asp Pro Ser Thr Leu Glu Lys Phe Leu Gly Arg
260 265 270

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Ile	Pro	Met	Ile	Phe	Asn	Val	Val	Val	Val	Ser	Pro	His	Gly	Tyr	Phe
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Gly	Gln	Ala	Asn	Val	Leu	Gly	Leu	Pro	Asp	Thr	Gly	Gly	Gln	Ile	Val
	290					295					300				
Tyr	Ile	Leu	Asp	Gln	Val	Arg	Ala	Leu	Glu	Asn	Glu	Met	Val	Leu	Arg
	305				310					315					320
Leu	Lys	Lys	Gln	Gly	Leu	Asp	Val	Ser	Pro	Lys	Ile	Leu	Ile	Val	Thr
			325						330					335	
Arg	Leu	Ile	Pro	Asp	Ala	Lys	Gly	Thr	Ser	Cys	Asn	Gln	Arg	Leu	Glu
			340					345					350		
Arg	Ile	Ser	Gly	Thr	Gln	His	Thr	Tyr	Ile	Leu	Arg	Val	Pro	Phe	Arg
		355					360				365				
Asn	Glu	Asn	Gly	Ile	Leu	Lys	Lys	Trp	Ile	Ser	Arg	Phe	Asp	Val	Trp
	370					375					380				
Pro	Tyr	Leu	Glu	Thr	Phe	Ala	Glu	Asp	Ala	Ala	Gly	Glu	Ile	Ala	Ala
	385					390				395					400
Glu	Leu	Gln	Gly	Thr	Pro	Asp	Phe	Ile	Ile	Gly	Asn	Tyr	Ser	Asp	Gly
				405					410					415	
Asn	Leu	Val	Ala	Ser	Leu	Leu	Ser	Tyr	Lys	Met	Gly	Ile	Thr	Gln	Cys
		420						425					430		
Asn	Ile	Ala	His	Ala	Leu	Glu	Lys	Thr	Lys	Tyr	Pro	Asp	Ser	Asp	Ile
		435					440				445				
Phe	Trp	Lys	Asn	Phe	Asp	Glu	Lys	Tyr	His	Phe	Ser	Cys	Gln	Phe	Thr
	450					455				460					
Ala	Asp	Ile	Ile	Ala	Met	Asn	Asn	Ala	Asp	Phe	Ile	Ile	Thr	Ser	Thr
	465				470				475					480	
Tyr	Gln	Glu	Ile	Ala	Gly	Ser	Lys	Asn	Thr	Val	Gly	Gln	Tyr	Glu	Ser
				485					490					495	
His	Thr	Ala	Phe	Thr	Leu	Pro	Gly	Leu	Tyr	Arg	Val	Val	His	Gly	Ile
		500						505					510		
Asp	Val	Phe	Asp	Pro	Lys	Phe	Asn	Ile	Val	Ser	Pro	Gly	Ala	Asp	Met
		515					520					525			
Ser	Ile	Tyr	Phe	Pro	His	Thr	Glu	Lys	Ala	Lys	Arg	Leu	Thr	Ser	Leu
		530				535					540				
His	Gly	Ser	Ile	Glu	Asn	Leu	Ile	Tyr	Asp	Pro	Glu	Gln	Asn	Asp	Glu
	545				550					555				560	
His	Ile	Gly	His	Leu	Asp	Asp	Arg	Ser	Lys	Pro	Ile	Leu	Phe	Ser	Met
			565						570					575	
Ala	Arg	Leu	Asp	Arg	Val	Lys	Asn	Ile	Thr	Gly	Leu	Val	Glu	Ala	Phe
		580						585					590		
Ala	Lys	Cys	Ala	Lys	Leu	Arg	Glu	Leu	Val	Asn	Leu	Val	Val	Ala	
		595					600				605				
Gly	Tyr	Asn	Asp	Val	Asn	Lys	Ser	Lys	Asp	Arg	Glu	Glu	Ile	Ala	Glu
		610				615					620				
Ile	Glu	Lys	Met	His	Glu	Leu	Ile	Lys	Thr	His	Asn	Leu	Phe	Gly	Gln
	625				630					635				640	
Phe	Arg	Trp	Ile	Ser	Ala	Gln	Thr	Asn	Arg	Ala	Arg	Asn	Gly	Glu	Leu
			645						650					655	
Tyr	Arg	Tyr	Ile	Ala	Asp	Thr	His	Gly	Ala	Phe	Val	Gln	Pro	Ala	Leu
			660					665					670		
Tyr	Glu	Ala	Phe	Gly	Leu	Thr	Val	Val	Glu	Ala	Met	Thr	Cys	Gly	Leu
		675					680					685			
Pro	Thr	Phe	Ala	Thr	Leu	His	Gly	Gly	Pro	Ala	Glu	Ile	Ile	Glu	His
		690				695					700				
Gly	Val	Ser	Gly	Phe	His	Ile	Asp	Pro	Tyr	His	Pro	Glu	Gln	Ala	Val
					710					715					720
Asn	Leu	Met	Ala	Asp	Phe	Phe	Asp	Arg	Cys	Lys	Gln	Asp	Pro	Asp	His
				725					730					735	

Trp Val Asn Ile Ser Gly Ala Gly Leu Gln Arg Ile Tyr Glu Lys Tyr
 740 745 750
 Thr Trp Lys Ile Tyr Ser Glu Arg Leu Met Thr Leu Ala Gly Val Tyr
 755 760 765
 Gly Phe Trp Lys Tyr Val Ser Lys Leu Glu Arg Leu Glu Thr Arg Arg
 770 775 780
 Tyr Leu Glu Met Phe Tyr Ile Leu Lys Phe Arg Glu Leu Ala Lys Thr
 785 790 795 800
 Val Pro Leu Ala Ile Asp Gln Pro Gln
 805

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 accgcaacgc gagcatccgg gaccgcgtcg aggacaccct ccacgcgcac cgcaacgagc 180
 tcgtcgccct cctctccaag tacgtgaaca aggggaaggg catcctgcag ccgcaccaca 240
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 tctcgacgt cctccgctcc gcgcaggagg cgatcgtgct gccgcgc 347

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